

A Taxonomical Review of the Genus *Aphelopus* (Hymenoptera: Dryinidae: Aphelopinae) from South Korea

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ABSTRACT

The species of *Aphelopus* Dalman (Hymenoptera: Dryinidae) from South Korea are reviewed. Sixteen species are listed, of which fifteen are new records from South Korea: *Aphelopus atratus* (Dalman, 1823); *Aphelopus bennetti* Olmi, 2004; *Aphelopus camus* Richards, 1939; *Aphelopus luteiceps* Xu & He, 1999; *Aphelopus maetoi* Olmi, 1995; *Aphelopus malayanus* Olmi, 1984; *Aphelopus melaleucus* (Dalman, 1818); *Aphelopus nepalensis* Olmi, 1984; *Aphelopus nigriceps* Kieffer, 1905; *Aphelopus prolatus* Mita & Olmi, 2014; *Aphelopus querceus* Olmi, 1984; *Aphelopus serratus* Richards, 1939; *Aphelopus spadiceus* Xu & He, 1997; *Aphelopus urbaini* Olmi, 2003; *Aphelopus zhaoi* Xu, He & Olmi, 1998. Keys to South Korean species of *Aphelopus* are also provided.

Keywords: *Aphelopus*, Dryinidae, key, new records, parasitoid, South Korea, taxonomy

INTRODUCTION

The genus *Aphelopus* belonging to the subfamily Aphelopinae of the family Dryinidae comprised 78 described species (Olmi and Xu, 2015). All of the species are worldwidely distributed, and 18 of them are from the Eastern Palaearctic. *Aphelopus* can be easily distinguished from other genera in the Dryinidae by the following combinations of characters: fore wing usually with only costal cell enclosed by pigment-ed veins; tibial spurs formula 1/1/2; occipital carina complete; female head hypognathous and protarsus not chelate.

As natural enemies, members of the *Aphelopus* are known to be the natural enemy of the Typhlocybinae (Hemiptera: Auchenorrhyncha: Cicadellidae) (Guglielmino and Olmi, 1997, 2006; Guglielmino et al., 2013). Therefore, *Aphelopus* species are important to natural control of agricultural pests.

Previously only one species was recorded from South Korea (Olmi, 2009). As part of recent study of Dryinidae in South Korea, we here newly report fifteen *Aphelopus* species from South Korea. Therefore, total 61 species in 10 genera, 5 subfamilies are now officially recognized for the South Korean dryinid fauna (Mita, 2009; Olmi, 2009; Lee and Kim, 2010; Kim et al., 2011, 2012, 2015; Kim and Lee, 2013, 2014, 2015, 2016).

MATERIALS AND METHODS

The morphological terminology used in the present study follows Olmi (1984, 1994, 1999). The images were captured with an AxioCam HRC camera through a Discovery V20 stereomicroscope and were produced with the AxioVision 40AC software (Carl Zeiss, Oberkochen, Germany). Final plates were prepared using Adobe Photoshop CS6.

Abbreviations are as follows: OL, distance between the inner edges of a lateral ocellus and the median ocellus; OOL, distance from the outer edge of a lateral ocellus to the compound eye; OPL, distance from the posterior edge of a lateral ocellus to the occipital carina; POL, distance between the inner edges of two lateral ocelli; TL, distance from the posterior edge of an eye to the occipital carina; MT, Malaise trap.

The material studied in the present paper is deposited at the Yeungnam University (YNU), Gyeongsan, South Korea.

SYSTEMATIC ACCOUNTS

Order Hymenoptera Linnaeus, 1758
Subfamily Aphelopinae R. Perkins, 1912
Genus *Aphelopus* Dalman, 1823

Type species: *Aphelopus atratus* Dalman, 1823 (designated by Westwood, 1840).

1. *Aphelopus atratus* (Dalman, 1823) (Figs. 1A, 2A)

Dryinus (*Aphelopus*) *atratus* Dalman, 1823: 15. Type locality: Västergötland (Sweden).

Aphelopus atratus (Dalman): Haliday, 1833: 273.

Aphelopus melaleucus (Dalman) var. *atratus* (Dalman): Kieffer, in Kieffer & Marshall, 1905: 219.

Aphelopus piceipes Kieffer, part.: Crèvecoeur & Maréchal, 1933: 153.

Aphelopus holomelas Richards, 1939: 289.

Aphelopus indivisus Kieffer: Buyckx, 1948: 63.

Aphelopus melaleucus (Dalman): Zangheri, 1969: 1672.

Material examined. South Korea: 1 ♀, Daejeon-si: Seo-gu, Wolpyeong-dong, Wolpyeong Park, 12 May–24 Jun 2008 (MT), Lee JW; 1 ♀, Gangwon-do: Chuncheon-si, 24, Hwa-mogwon-gil, Gangwon Provincial Arboretum, 5–18 Jul 2011 (MT), Lee JW; 1 ♂, *ditto*, 30 May–14 Jun 2013 (MT), Kim IG; 1 ♂, Pyeongchang-gun, Jinbu-myeon, Odaesan-ro, 2, Odaesan National Park, Alt. 429 m, 37°47'46"N, 128°40'45"E, Jul–30 Aug 2013 (MT), Park JY; 1 ♂, Gyeongsangnam-do: Uiryeong-gun, Bongsu-myeon, Daehan-ro, 1234, 16 May–7 Jun 2014 (MT), Lee JW.

Diagnosis. Female: Head black, except mandible yellowish brown; antenna dark brown, except 1–2 segments yellowish brown; mesosoma black; legs yellowish brown; metasoma brown. Head dull, granulated; frontal line complete; occipital carina complete; POL = 12; OL = 5; OOL = 7; OPL = 5; TL

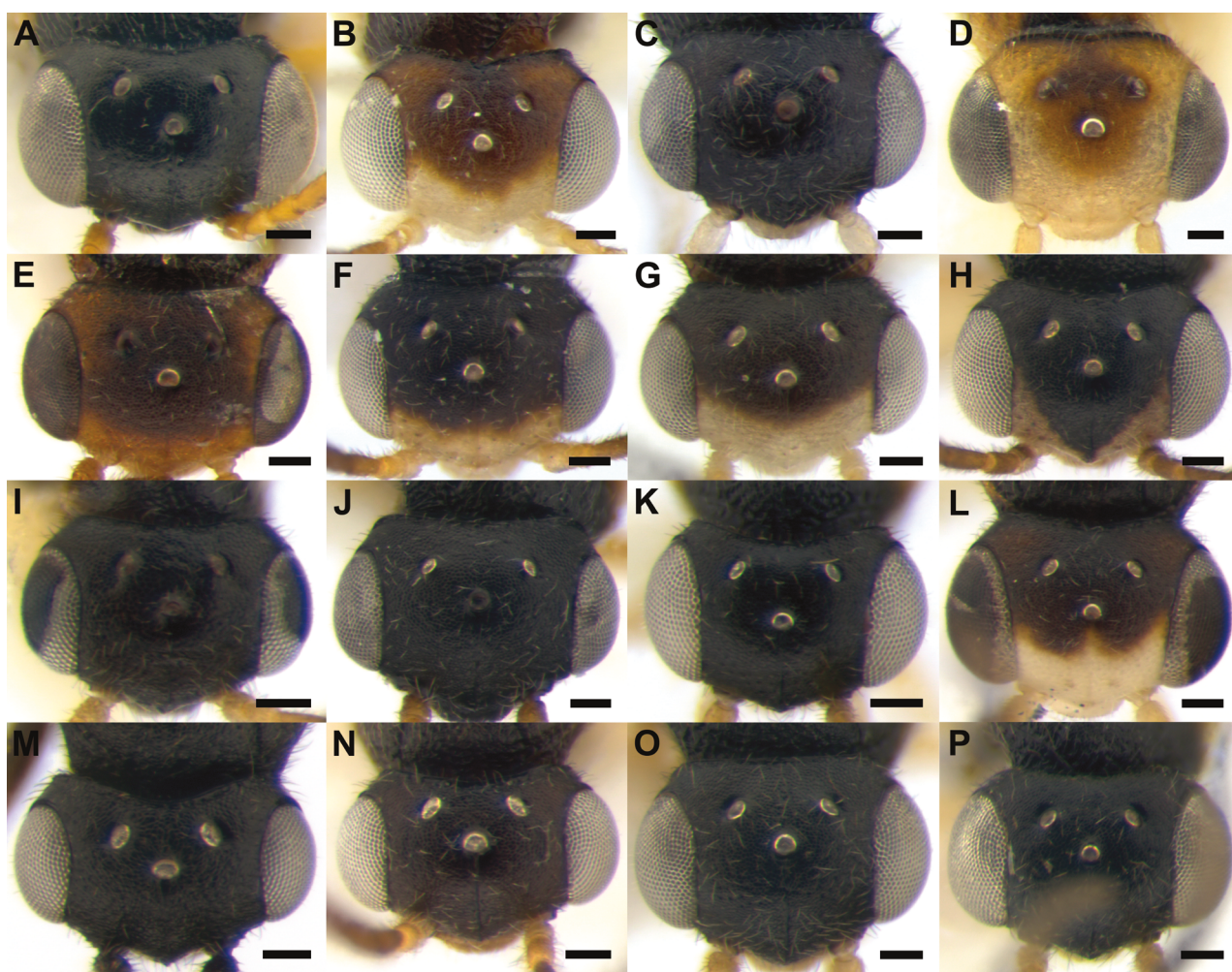


Fig. 1. Heads of *Aphelopus* spp. (in dorsal view). A, *A. atratus*, female; B, *A. bennetti*, female; C, *A. camus*, female; D, *A. koreanus*, female; E, *A. luteocephus*, male; F, *A. maetoi*, female; G, *A. malayanus*, female; H, *A. melaleucus*, female; I, *A. nepalensis*, female; J, *A. nigriceps*, female; K, *A. prolatus*, female; L, *A. querceus*, female; M, *A. serratus*, female; N, *A. spadiceus*, male; O, *A. urbaini*, female; P, *A. zhaoi*, female. Scale bars=0.1 mm.

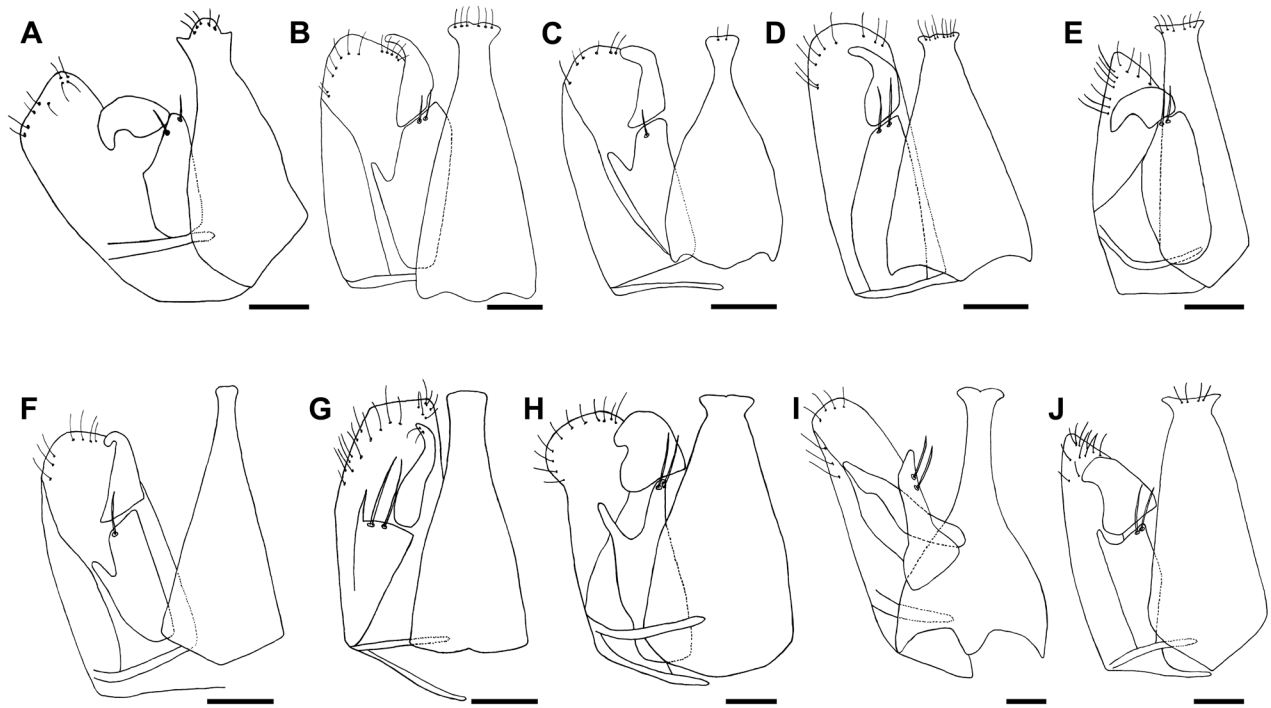


Fig. 2. Male genitalia of *Aphelopus* spp. A, *A. atratus*; B, *A. bennetti*; C, *A. camus*; D, *A. luteocephus*; E, *A. maetoi*; F, *A. melaleucus*; G, *A. prolatus*; H, *A. querceus*; I, *A. serratus*; J, *A. spadiceus*. Scale bars=0.05 mm.

=5. Scutum dull, granulated. Notauli incomplete, reaching approximately $0.5 \times$ length of scutum. Posterior surface of propodeum with two complete longitudinal keels.

Male genitalia. Distal apex of aedeagus tridentate. Basivolsella with two subdistal bristles, without an outer basal process.

Distribution. South Korea (new record), Transpalearctic from Europe to Russian Far East, Japan.

Host. Unknown in South Korea. About records from other countries, see Guglielmino et al. (2013).

Parasitoids. Unknown in South Korea. About records from other country, see Buyckx (1948).

Remarks. This species is widely distributed in the Palearctic. A female specimen from Gangwon Provincial Arboretum is morphologically distinguished from the type and other countries specimens by the following characters: color of antenna dark brown except 1–5 segments yellowish brown; notauli incomplete, reaching approximately $0.6 \times$ length of scutum; posterior surface of propodeum with median area smooth, less rugose than lateral areas and sculptured by weak irregular keels.

2. *Aphelopus bennetti* Olmi, 2004 (Figs. 1B, 2B)

Aphelopus bennetti Olmi, 2004: 301. Type locality: Sakhalin Island (Russia).

Material examined. South Korea: 1 ♂, Gangwon-do: Donghae-si, Samhwa-ro, 538, Mureung valley, $37^{\circ}27'26.28''\text{N}$, $129^{\circ}04'57.68''\text{E}$, 16–28 Jun 2005 (MT), Lee JW; 1 ♀, Gyeonggi-do: Anyang-si, Manan-gu, Mt. Gwanaksan, 9–24 Jun 2007 (MT), Lim JO; 1 ♂, Pocheon-si, Soheung-eup, Gwangneungsumogwon-ro, 415, Korea National Arboretum, $37^{\circ}45'1.9''\text{N}$, $127^{\circ}08'34.4''\text{E}$, 1–16 Aug 2012 (MT), Kim IG; 1 ♂, Gyeongsangbuk-do: Gunwi-gun, Bugye-myeon, Wonhyo-gil, 280-103, $36^{\circ}01'29.04''\text{N}$, $128^{\circ}41'31.11''\text{E}$, 15 Jul–29 Aug 2014 (MT), Lee JW; 1 ♂, Gyeongsangnam-do: Danyang-gun, Danyang-eup, $36^{\circ}57'25.1''\text{N}$, $128^{\circ}25'47.6''\text{E}$, 12 Jun–22 Jul 2008 (MT), Lee JW.

Diagnosis. Female: Head brown, except mandible, clypeus, anterior two thirds of face whitish; two yellowish brown spots between ocellar triangle and eyes; antenna brown, except 1–2 segments yellowish brown; mesosoma dark brown; legs whitish; metasoma brown. Head dull, granulated; frontal line complete; occipital carina complete, excavated behind ocellar triangle; POL = 11; OL = 8; OOL = 6; OPL = 7; TL = 7. Scutum dull, granulated. Notauli incomplete, reaching approximately $0.6 \times$ length of scutum. Posterior surface of propodeum with two complete longitudinal keels. **Male genitalia.** Basivolsella with two subdistal bristles and outer basal process.

Distribution. South Korea (new record), Japan, Russia (Far

East).

Host. Unknown.

Remarks. A female specimen from Anyang, Gyeonggi shows that body color is much brownish than other specimens, not blackish. The occipital carina excavated behind the ocellar triangle is unique character among other species.

3. *Aphelopus camus* Richards, 1939 (Figs. 1C, 2C)

Aphelopus camus Richards, 1939: 287. Type locality: Storey's Way (UK).

Aphelopus heidelbergensis Richards, 1939: 286 (synonymized by J. Perkins, 1976).

Aphelopus piceipes Kieffer: Zangheri, 1969: 1672.

Aphelopus empoasca Ponomarenko, 1970: 428 (synonymized by Olmi, 1998).

Material examined. South Korea: 2♂♂, Gangwon-do: Wonju-si, Heungeop-myeon, Yonseidae-gil, 1, Yonsei University, 37°16'54.49"N, 127°53'54.54"E, 21 Apr–29 May 2015 (MT), Han HY; 1♂, *ditto*, 29 May–5 Jul 2015 (MT), Han HY; 1♂, Gyeonggi-do: Anyang-si, Manan-gu, Yesulgongwon-ro, 280, Gwanak Arboretum, Alt. 175 m, 37°25'14"N, 126°57'01"E, 26 Jun–4 Jul 2007 (MT), Kim JG; 1♀, *ditto*, Alt. 219 m, 37°18'5.3"N, 127°19'1.5"E, 5–49 Jul 2007 (MT), Lim JO; 1♀, Gyeongsangbuk-do: Cheongdo-gun, Gakbuk-myeon, Mt. Biseulsan, 19 Aug–6 Sep 2015 (MT), Lee JW.

Diagnosis. Female: Head black, except mandible, clypeus yellowish brown; antenna blackish brown, except 1–2 or 1–3 segments yellowish brown; mesosoma and metasoma black; legs whitish yellow except metafemur yellowish brown, metatibia dark brown. Head dull, granulated; frontal line incomplete; occipital carina complete; POL = 8; OL = 4; OOL = 4; OPL = 3; TL = 3. Scutum dull, granulated. Notauli incomplete, reaching approximately 0.6 × length of scutum. Posterior surface of propodeum with two complete longitudinal keels.

Male genitalia. Basivolsella with one subdistal bristle and outer basal process.

Distribution. South Korea (new record), Transpalearctic from Europe to Russian Far East, Japan.

Host. Unknown in South Korea. About records from other countries, see Guglielmino et al. (2013).

4. *Aphelopus koreanus* Olmi, 2009 (Fig. 1D)

Aphelopus koreanus Olmi, 2009: 128. Type locality: Odaesan, near Woljeongsan (South Korea).

Material examined. South Korea: 1♀, Daegu-si: Dalseogu, Daegok-dong, Hwaam-ro, 342, Daegu Arboretum, Alt. 88 m, 35°47'48.6"N, 128°31'33.5"E, 16–30 May 2012 (MT),

Kang SG; 1♀, Jinju-si: Ibanseong-myeon, Sumogwon-ro, 386, Gyeongsangnamdo Arboretum, 15–31 Aug 2011 (MT), Lee JW; 1♀, Gyeongsangnam-do: Uiryeong-gun, Bongsu-myeon, Daehan-ro, 1234, 15 Aug–15 Sep 2014 (MT), Lee JW.

Diagnosis. Female: Head yellowish brown, except ocellar area dark brown; antenna brown, except 1–2 or 1–4 segments yellowish brown; mesosoma yellowish brown except metanotum and dorsal part of propodeum black; legs whitish; metasoma dark brown. Head dull, granulated; frontal line incomplete; occipital carina complete; POL = 15; OL = 10; OOL = 8; OPL = 10; TL = 10. Scutum dull, granulated. Notauli incomplete, reaching approximately 0.6 × length of scutum. Posterior surface of propodeum with two complete longitudinal keels.

Distribution. Japan, South Korea.

Host. Unknown.

Remarks. The male is unknown. This species is only known in the Eastern Palearctic: Japan and South Korea.

5. *Aphelopus luteiceps* Xu & He, 1999 (Figs. 1E, 2D)

Aphelopus luteiceps Xu & He, 1999: 1. Type locality: Zhejiang, Mt. Tianmushan (China).

Material examined. South Korea: 1♂, Gyeonggi-do: Gwangju-si, Docheok-myeon, Mt. Taehwasan, Alt. 243 m, 25 May–8 Jun 2007 (MT), Lim JO; 1♂, Gyeongsangbuk-do: Cheongdo-gun, Unmun-myeon, Haksodae waterfall, 35°38'15"N, 128°59'51"E, 2 Jul–16 Aug 2013 (MT), Lee JW; 1♂, Jeju-si: Ara-dong, Ara valley, 33°27'N, 126°33'E, 22 Sep–4 Nov 2008 (MT), Lee JW.

Diagnosis. Male: Head yellowish brown, except ocellar region, central area of vertex black; antenna yellowish brown, except 1–2 segments brown; mesosoma black except prothorax yellow; legs yellowish brown; metasoma dark brown. Head dull, granulated; frontal line incomplete; occipital carina complete; POL = 15; OL = 7; OOL = 8; OPL = 7; TL = 7. Scutum dull, granulated. Notauli incomplete, reaching approximately 0.6 × length of scutum. Posterior surface of propodeum with two complete longitudinal keels. Basivolsella with two subdistal bristles, without an outer basal process.

Distribution. South Korea (new record), China.

Host. Unknown.

Remarks. The female is unknown.

6. *Aphelopus maetoi* Olmi, 1995 (Figs. 1F, 2E)

Aphelopus maetoi Olmi, 1995: 5. Type locality: Hokkaido, Sapporo (Japan).

Aphelopus hei Xu & Lou, 1996: 174 (synonymized by Olmi, 2000).

Material examined. Russia: 1♂, Sakhalin, Yuzhno-Sakhalinsk, Khnstoforovka, 46°51'48"N, 142°50'30"E, 17 Jul 2008, Lee JW; South Korea: 1♀ 1♂, Chungcheongnam-do: Seosan-si, Haemi-myeon, Hanseol-ro, 46, Hanseo University, 1–25 Jun 2013 (MT), Lee JW; 1♀, Daejeon-si: Dong-gu, Daehak-ro, 62, Daejeon University, 1–15 Jun 2006 (MT), Lee JW; 1♀, Gangwon-do: Chuncheon-si, Hwamogwongil, 24, Gangwon Provincial Arboretum, Alt. 81 m, 37°55'23.7"N, 127°43'31.7"E, 15–27 Sep 2012 (MT), Lee GY; 1♂, Pyeongchang-gun, Yongpyeong-myeon, Mt. Gyebangsan, 28 Jun–12 Aug 2012 (MT), Park JY; 1♀, Wonju-si, Mt. Baegunsan, 37°15'30.05"N, 127°58'55.11"E, 6–19 Jun 2011 (MT), Han HY; 1♀, Gyeongsangbuk-do: Cheongdo-gun, Unmun-myeon, Simsim valley, 35°37'44"N, 128°59'01"E, 17 May–22 Jun 2014 (MT), Lee JW; 1♀, Chilgok-gun, Dongmyeong-myeon, 36°01'53.45"N, 128°33'46.93"E, 15 May–11 Jun 2014 (MT), Lee JW; 2♀♀, *ditto*, 12 Jun–14 Jul 2014 (MT), Lee JW; 2♀♀, *ditto*, 15 Jul–29 Aug 2014 (MT), Lee JW; 1♀, Gyeongsan-si, Daehak-ro, 280, Yeungnam University, 35°58'N, 128°47'E, 27 May–2 Jun 2008 (MT), Lee JW; 2♀♀, Seoul-si: Dongdaemun-gu, Cheongnyangni-dong, 8–15 Aug 2005 (MT), Choi WI; 1♂, Jinju-si: Ibanseong-myeon, Sumogwon-ro, 386, Gyeongsangnamdo Arboretum, 17–30 Jun 2011 (MT), Lee JW; 1♂, Jeollabuk-do: Wanju-gun, Dongsang-myeon, Daeasumogwon-ro, 94–34, Daea Arboretum, 35°58'24.24"N, 127°18'13.53"E, 1–15 Aug 2013 (MT), Park JM.

Diagnosis. Female: Head dark brown, except mandible, clypeus and gena whitish; anterior third to entire of face whitish; vertex with or without reddish brown spots; antenna brown, except 1–2 or 1–3 segments yellowish brown; mesosoma brown or black except propleuron and lateral part of pronotum or only propleuron yellowish brown; legs whitish yellow; metasoma dark brown. Head dull, granulated; frontal line complete; occipital carina complete; POL = 11; OL = 7; OOL = 6; OPL = 7; TL = 7. Scutum dull, granulated. Notauli incomplete, reaching approximately 0.4–0.7 × length of scutum. Posterior surface of propodeum with two complete longitudinal keels.

Male genitalia. Basivolsella with two subdistal bristles, without an outer basal process.

Distribution. South Korea (new record), China, Japan, Russia (Far East).

Host. Unknown.

7. *Aphelopus malayanus* Olmi, 1984 (Fig. 1G)

Aphelopus malayanus Olmi 1984: 66. Type locality: Malaya (Malaysia).

Material examined. South Korea: 1♀, Gyeonggi-do: Gapyeong-gun, Cheongpyeong-myeon, Mt. Homyeongsan,

37°43'16.3"N, 127°19'23.4"E, 31 Jul–17 Aug 2009 (MT), Lim JO; 1♀, Yangpyeong-gun, Yongmun-myeon, Mt. Yongmunsan, Alt. 324 m, 37°31'49.5"N, 127°34'18.8"E, 31 Jul–17 Aug 2009 (MT), Lim JO; 1♀, Gyeongsangbuk-do: Cheongdo-gun, Gakbuk-myeon, Mt. Biseulsan, 19 Aug–6 Sep 2015 (MT), Lee JW; 1♀, Cheongdo-gun, Gakbuk-myeon, 35°38'N, 128°47'E, 9 Jun–1 Aug 2013 (MT), Lee JW; 1♀, *ditto*, 1 Aug–15 Sep 2013 (MT), Lee JW.

Diagnosis. Female: Head yellowish brown, except vertex, occiput, posterior half of face dark brown; antenna brown, except 1–4 segments yellowish brown; mesosoma yellowish brown except dorsal regions blackish brown; legs yellow; metasoma dark brown. Head dull, granulated; frontal line complete; occipital carina complete; POL = 11; OL = 6; OOL = 7; OPL = 8; TL = 8. Scutum dull, granulated. Notauli incomplete, reaching approximately 0.5 × length of scutum. Posterior surface of propodeum with two complete longitudinal keels.

Distribution. South Korea (new record), Brunei, China, India, Indonesia, Laos, Malaysia, Nepal, Philippines, Thailand.

Host. Unknown in South Korea. About records from other countries, see Guglielmino et al. (2013).

Remarks. This species, widely distributed in the Oriental Region, is now reported for the first time from the Palearctic (South Korea).

8. *Aphelopus melaleucus* (Dalman, 1818) (Figs. 1H, 2F)

Gonatopus melaleucus Dalman, 1818: 82. Type locality: Västergötland (Sweden).

Dryinus (Aphelopus) melaleucus (Dalman): Dalman, 1823: 14.

Aphelopus melaleucus (Dalman): Haliday, 1833: 273.

Ceraphron albipes Ratzeburg, 1848: 141 (synonymized by Olmi, 1984).

Aphelopus albipes Kieffer, in Kieffer & Marshall, 1905: 217 (synonymized by Olmi, 1984).

Aphelopus trisulcatus Kieffer, 1914: 216 (synonymized by Olmi, 1984).

Aphelopus carinatus Kieffer, part.: Crèvecoeur & Maréchal, 1933: 152.

Material examined. South Korea: 1♀, Chungcheongbuk-do: Gyeryong-si, Sindoon-myeon, Mt. Gyeryongsan, Donghaksan upper, 14 Mar–28 Aug 2012 (MT), Jeong JC; 1♀, Gyeryong-si, Sindoon-myeon, Mt. Gyeryongsan, Dongwol, 26 Mar–28 Aug 2012 (MT), Jeong CJ; 1♀, 319, Gangwon-do: Hongcheon-gun, Bukbang-myeon, Saengtaegongwongil, Gangwon Environment Research Park, 8–16 Aug 2011 (MT), Lee JW; 1♂, *ditto*, 35°45'15.6"N, 127°51'1.7"E, 15–30 May 2012 (MT), Jang SJ; 1♂, Wonju-si, Heungeop-

myeon, Yonseidae-gil, 1, Yonsei University, 37°16'24"N, 127°54'02"E, 20 Jun–22 Jul 2007 (MT), Lee JW; 1 ♂, *ditto*, 11 Aug–8 Sep 2007 (MT), Lee JW; 2 ♀♀, *ditto*, 37°16'54.49"N, 127°53'54.54"E, 29 May–5 Jul 2015 (MT), Han HY; 1 ♂, Pyeongchang-gun, Jinbu-myeon, Odaesan-ro, 2, Odaesan National Park, Alt. 1,109 m, 37°47'16"N, 128°33'26"E, Jul–30 Aug 2013 (MT), Park JY; 1 ♀, Gyeongsangbuk-do: Cheongdo-gun, Gakbuk-myeon, 35°58'N, 128°47'E, 9 Jul–1 Sep 2012 (MT), Lee JW; 1 ♂, Gyeongsangnam-do: Jinju-si, Ibanseong-myeon, 4–11 Jul 2005 (MT), An BG; 1 ♀, Gyeongsangnamdo Forest Environment Research Institute, *ditto*, Alt. 43 m, 35°09'39.7"N, 128°17'41.3"E, 1–16 Jul 2012 (MT), Hwang JH; 1 ♀, Jeollabuk-do: Wanju-gun, Dongsang-myeon, Daesumogwon-ro, 94-34, Daea Arboretum, 13–24 Jul 2011 (MT), Lee JW.

Diagnosis. Female: Head blackish brown, except mandible, clypeus, gena, lower half of face whitish; vertex with or without reddish brown spots; antenna dark brown, except 1–2 yellowish brown; mesosoma black; legs whitish yellow; metasoma dark brown. Head dull, granulated; frontal line complete; occipital carina complete; POL = 9; OL = 6; OOL = 7; OPL = 7; TL = 7. Scutum dull, granulated. Notauli incomplete, reaching approximately $0.5 \times$ length of scutum. Posterior surface of propodeum with two complete longitudinal keels.

Male genitalia. Basivolsella with one subdistal bristle and an outer basal process.

Distribution. South Korea (new record), Transpalearctic from Europe to Russian Far East, China and Japan.

Host. Unknown in South Korea. About records from other countries, see Guglielmino et al. (2013).

Remarks. This species is widely distributed in the Palearctic.

9. *Aphelopus nepalensis* Olmi, 1984 (Fig. 1I)

Aphelopus nepalensis Olmi, 1984: 57. Type locality: Bokai-hunde (Nepal).

Material examined. Japan: 1 ♂, Hokkaido, Sapporo, Hilsujgoka, Hokkaido National Agricultural Experiment Station, Alt. 133 m, 35°00'30"N, 141°24'47.3"E, 30 Jun–2 Jul 2009 (MT), Lee JW; South Korea: 1 ♀, 94, Ulsan-si, Nam-gu, Daegongwon-ro, 9 Sep–7 Nov 2011 (MT), Lee JW.

Diagnosis. Female: Head black, except mandible yellowish brown; antenna brown, except 1–3 yellowish brown; mesosoma and metasoma blackish brown; legs yellowish brown. Head dull, granulated; frontal line incomplete; occipital carina complete; POL = 10; OL = 6; OOL = 7; OPL = 4; TL = 6. Scutum dull, granulated. Notauli incomplete, reaching approximately $0.5 \times$ length of scutum. Posterior surface of propodeum with two complete longitudinal keels.

Distribution. South Korea (new record), China, Japan, Nepal.

Host. Unknown.

10. *Aphelopus nigriceps* Kieffer, 1905 (Fig. 1J)

Aphelopus melaleucus (Dalman) var. *nigriceps* Kieffer, in Kieffer & Marshall, 1905: 219. Type locality: Dumfries, Scotland (UK).

Aphelopus nigriceps Kieffer: Kieffer, 1914: 216.

Aphelopus piceipes Kieffer, part.: Crèvecoeur & Maréchal, 1933: 153.

Material examined. South Korea: 1 ♀, Gangwon-do: Wonju-si, Heungeop-myeon, 1, Yonseidae-gil, Yonsei University, 37°16'54.49"N, 127°53'54.54"E, 29 May–5 Jul 2015 (MT), Han HY; 1 ♀, Pyeongchang-gun, Jinbu-myeon, Odaesan-ro, 2, Odaesan National Park, 37°47'46"N, 128°40'45"E, 22 May–12 Jun 2013 (MT), Park JY; 1 ♀, Gyeonggi-do: Pocheon-si, Soheung-eup, Gwangneungsumogwon-ro, 415, Korea National Arboretum, 37°45'9.1"N, 127°09'4.7"E, 31 May–14 Jun 2013 (MT), Kim IG; 1 ♀, Gyeongsangbuk-do: Cheongdo-gun, Unmun-myeon, Mt. Unmunsan, 35°38'45"N, 128°57'33"E, 23 May–6 Jun 2008 (MT), Kim CJ.

Diagnosis. Female: Head black, except mandible yellowish brown; antenna dark brown, except 1–2 yellowish brown; mesosoma and metasoma black; legs yellowish brown except metacoxa, metafemur and part of metatibia brown. Head dull, granulated; frontal line incomplete; occipital carina complete; POL = 15; OL = 8; OOL = 8; OPL = 8; TL = 7. Scutum dull, granulated. Notauli incomplete, reaching approximately $0.65 \times$ length of scutum. Posterior surface of propodeum with two complete longitudinal keels.

Distribution. South Korea (new record), Transpalearctic from Europe to China and Japan.

Host. Unknown in South Korea. About records from other countries, see Guglielmino et al. (2013).

Remarks. This species is widely distributed in the Palearctic.

11. *Aphelopus prolatus* Mita & Olmi, 2014 (Figs. 1K, 2G)

Aphelopus prolatus Mita & Olmi, 2014: 95. Type locality: Zennyûji-tô Island (Japan).

Material examined. South Korea: 2 ♀♀ 1 ♂, Gyeongsangnam-do, Uiryeong-gun, Bongsu-myeon, Daehan-ro, 1234, 7 Jun–10 Jul 2014 (MT), Lee JW.

Diagnosis. Male: Fully winged; body length 1.80 mm. Head black, except mandible yellowish brown; antenna brown, except 1–2 segments yellowish brown; mesosoma black; legs yellowish brown; metasoma brown. Antenna filiform;

antennal segments in following proportions: 5 : 6 : 8 : 8 : 10 : 11 : 11 : 11 : 11 : 13. Head dull, granulate; frontal line complete; occipital carina complete; POL = 13; OL = 7; OOL = 4; OPL = 2; TL = 3. Scutum, scutellum and metanotum dull, granulated. Notauli almost absent, hardly visible near anterior margin. Propodeum dull, with dorsal surface reticulate rugose; posterior surface with two complete longitudinal keels, median area shiny, smooth, unsculptured and lateral areas rugose. Forewing hyaline, without dark transverse bands. Distal apex of aedeagus not tridentate. Basivolsella fused with paramere and with two subdistal bristles, without an outer basal process.

Distribution. South Korea (new record), Japan, Sweden.

Host. Unknown.

Remarks. All known male specimens (including type) are antennal segments missing after the fifth segments. We provide a detail diagnosis of the male, considering the lacking male antenna description.

12. *Aphelopus querceus* Olmi, 1984 (Figs. 1L, 2H)

Aphelopus querceus Olmi, 1984: 59. Type locality: Bhurumche (Nepal).

Material examined. South Korea: 1 ♂, Gangwon-do: Pyeongchang-gun, Jinbu-myeon, Odaesan-ro, 2, Odaesan National Park, 37°47'46"N, 128°40'45"E, 6 Jun–26 Jul 2013 (MT), Kim CJ; 1 ♀, Gyeonggi-do: Gwangju-si, Docheog-myeon, Mt. Taehwasan, Alt. 219 m, 9–24 Jun 2007 (MT), Lim JO; 3 ♂♂, Pocheon-si, Soheung-eup, Gwangneungsumogwon-ro, 415, Korea National Arboretum, 37°45'1.9"N, 127°08'34.4"E, 1–16 Aug 2012 (MT), Kim IG; 1 ♀, Gyeongsangbuk-do: Chilgok-gun, Dongmyeong-meyon, 36°01'53.45"N, 128°33'46.93"E, 15 Jul–29 Aug 2014 (MT), Lee JW; 1 ♂, Gyeongsan-si, Daehak-ro, 280, Yeungnam University, 14 Jun–15 Jul 2007 (MT), Lee JW; 1 ♂, Gyeongsangnam-do: Uiryeong-gun, Bongsu-myeon, Daehan-ro, 1234, 7 Jun–10 Jul 2014 (MT), Lee JW; 1 ♂, Jeollabuk-do: Wanju-gun, Dongsang-myeon, Daeasumogwon-ro, 94-34, Dae Arboretum, 18 Jun–12 Jul 2011 (MT), Lee JW; 1 ♂, Jeollanam-do: Goheung-gun, Jeomam-myeon, Mt. Palyeongsan, 11 Jul–12 Sep 2012 (MT), Jeong JC.

Diagnosis. Female: Head dark brown, except mandible, clypeus, lower half of face whitish; vertex with or without reddish brown spots; antenna brown, except 1–2 whitish; mesosoma black; legs whitish; metasoma brown. Head dull, granulated; frontal line complete; occipital carina complete; POL = 12; OL = 7; OOL = 7; OPL = 8; TL = 9. Scutum dull, granulated. Notauli incomplete, reaching approximately $0.65 \times$ length of scutum. Posterior surface of propodeum with two complete longitudinal keels.

Male genitalia. Basivolsella with two subdistal bristles and an outer basal process.

Distribution. South Korea (new record), Transpalaeartic from Europe to China and Japan.

Host. Unknown in South Korea. About records from other countries, see Guglielmino et al. (2013).

Remarks. This species is widely distributed in the Palaearctic.

13. *Aphelopus serratus* Richards, 1939 (Figs. 1M, 2I)

Aphelopus serratus Richards, 1939: 284. Type locality: Norwood (UK).

Material examined. South Korea: 1 ♀, Gangwon-do: Donghae-si, Samhwa-ro, 538, Mureung valley, 10–31 Aug 2005 (MT), Lee JW; 1 ♂, Gyeongsangbuk-do: Cheongdo-gun, Unmun-myeon, Simsim valley, 35°37'44"N, 128°59'01"E, 17 May–22 Jun 2014 (MT), Lee JW.

Diagnosis. Female: Head dark brown, except mandible whitish; antenna brown, except 1–2 yellowish brown; mesosoma dark brown; legs whitish yellow except metafemur and metatibia brown; metasoma brown. Head dull, granulated; frontal line complete; occipital carina complete; POL = 11; OL = 6; OOL = 5; OPL = 4; TL = 4. Scutum dull, granulated. Notauli incomplete, reaching approximately $0.75 \times$ length of scutum. Posterior surface of propodeum with two complete longitudinal keels.

Male genitalia. Basivolsella long and narrow and distally pointed with two subdistal bristles.

Distribution. South Korea (new record), Transpalaeartic from Europe to China and Japan.

Host. Unknown in South Korea. About records from other countries, see Guglielmino et al. (2013).

Parasitoids. Unknown in South Korea. About records from other country, see Olmi (2000).

Remarks. This species is widely distributed in the Palaearctic.

14. *Aphelopus spadiceus* Xu & He, 1997 (Figs. 1N, 2J)

Aphelopus spadiceus Xu & He in Xu et al., 1997: 8. Type locality: Mt. Fanjingshan (China).

Material examined. South Korea: 5 ♂♂, Daejeon-si: Donggu, Daehak-ro, 62, Daejeon University, 1–15 Jun 2006 (MT), Lee JW; 2 ♂♂, Gangwon-do: Pyeongchang-gun, Yongpyeong-myeon, Mt. Gyebangsang, 28 Jun–12 Aug 2012 (MT), Park JY; 1 ♂, Gyeonggi-do: Gwangju-si, Docheok-myeon, Mt. Taehwasan, Alt. 243 m, 37°18'5.3"N, 127°19'1.5"E, 25 May–8 Jun 2007 (MT), Lim JO; 1 ♂, Osan-si, Cheonghak-ro, 211, Mulhyanggi Arboretum, Alt. 38 m, 37°10'3.1"N,

127°03'24.2"E, 16–30 Aug 2013 (MT), Kwon YD, Ji YM; 1♂, Gyeongsangbuk-do: Cheongdo-gun, Unmun-myeon, Haksodae waterfall, 35°38'15"N, 128°59'51"E, 22–28 Jun 2014 (MT), Lee JW; 2♂♂, *ditto*, 28 Jun–19 Jul 2014 (MT), Lee JW.

Diagnosis. Male: Head black, except mandible whitish; antenna blackish brown; mesosoma and metasoma black; legs yellowish brown except all coxae dark brown, all femora and metatibia brown. Head dull, granulated; frontal line incomplete; occipital carina complete; POL = 14; OL = 7; OOL = 7; OPL = 4; TL = 6. Scutum dull, granulated. Notauli incomplete, reaching approximately 0.8 × length of scutum. Posterior surface of propodeum with two complete longitudinal keels. Basivolsella with two subdistal bristles and an outer basal process.

Distribution. South Korea (new record), Brunei, China, Thailand.

Host. Unknown.

15. *Aphelopus urbaini* Olmi, 2003 (Fig. 10)

Aphelopus urbaini Olmi, 2003: 22. Type locality: Shikotan Island, Inland of Gorobets Bay (Russia).

Material examined. Japan: 1♀ 7♂♂, Hokkaido, Minamifurano-cho, Ikutara, Alt. 520 m, 43°04'N, 142°41'E, 25 Jun–16 Jul 2009 (MT), A. Ueda leg; South Korea: 1♀, Jeollabuk-do, Wanju-gun, Dongsang-myeon, Daeasumogwon-ro, 94–34, Daea Arboretum, 25 Apr–4 May 2011 (MT), Lee JW.

Diagnosis. Female: Head black, except mandible and clypeus yellowish brown; antenna dark brown, except 1–2 brown; mesosoma black; legs brown except foreleg and mesocoxa yellowish brown; metasoma brown. Head dull, granulated; frontal line incomplete; occipital carina complete; POL = 14; OL = 8; OOL = 9; OPL = 8; TL = 9. Scutum dull, granulated. Notauli incomplete, reaching approximately 0.6 × length of scutum. Posterior surface of propodeum with two complete longitudinal keels.

Distribution. South Korea (new record), China, Japan, Russia (Far East).

Host. Unknown.

Remarks. This species is restricted to Eastern Palaearctic.

16. *Aphelopus zhaoi* Xu, He & Olmi, 1998 (Fig. 1P)

Aphelopus zhaoi Xu et al., 1998: 22. Type locality: Mt. Wuyishan (China).

Material examined. South Korea: 1♀, Gyeongsangbuk-do: Cheongdo-gun, Gakbuk-myeon, 35°58'N, 128°47'E, 9 Jul–1 Sep 2012 (MT), Lee JW.

Diagnosis. Female: Head black, except mandible and cly-

peus whitish yellow; antenna brown, except 1–3 yellowish brown; mesosoma black except scutellum reddish brown; fore and midlegs whitish; hindleg yellowish brown except tibia brown; metasoma dark brown. Head dull, granulated; frontal line complete; occipital carina complete; POL = 12; OL = 7; OOL = 6; OPL = 6; TL = 5. Scutum dull, granulated. Notauli incomplete, reaching approximately 0.65 × length of scutum. Posterior surface of propodeum with two complete longitudinal keels.

Distribution. South Korea (new record), China.

Host. Unknown.

Remarks. The male is unknown.

Key to the South Korean species of *Aphelopus*

Females (female of *Aphelopus luteiceps* is unknown and female of *A. spadiceus* has not been found in South Korea)

1. Head entirely yellowish brown 2
- Head entirely black or brown 3
2. Mesosoma yellowish brown, except dorsal regions brown or black; OL slightly shorter than OOL (Fig. 1G) *A. malayanus* Olmi
- Mesosoma yellowish brown, except metanotum and propodeum brown or black; OL slightly longer than OOL (Fig. 1D) *A. koreanus* Olmi
3. Head with clypeus black 4
- Head with clypeus yellowish brown or whitish 8
4. Notauli absent *A. prolatus* Mita & Olmi
- Notauli present 5
5. Frontal line complete (Fig. 1A) *A. atratus* (Dalman)
- Frontal line incomplete 6
6. Notauli reaching 0.75–0.85 × length of scutum *A. serratus* Richards
- Notauli reaching 0.50–0.65 × length of scutum 7
7. Notauli reaching 0.50–0.60 × length of scutum; POL slightly longer than OOL *A. nepalensis* Olmi
- Notauli reaching 0.65 × length of scutum; POL much longer than OOL *A. nigriceps* Kieffer
8. Occipital carina with a notch behind ocellar region (Fig. 1B) *A. bennettii* Olmi
- Occipital carina without a notch behind ocellar region 9
9. Head with clypeus completely black 10
- Head with clypeus partly yellowish brown or whitish 12
10. Frontal line absent (Fig. 1C) *A. camus* Richards
- Frontal line present 11
11. Frontal line incomplete, present in anterior half of face (Fig. 1O); notauli reaching 0.60 × length of scutum; scutellum black *A. urbaini* Olmi
- Frontal line complete (Fig. 1P); notauli reaching 0.65–

- 0.70 × length of scutum; scutellum brown
 *A. zhaoi* Xu, He & Olmi
12. Dorsal margin of yellowish brown region on frons U-shaped (Fig. 1H) *A. melaleucus* (Dalman)
 – Dorsal margin of yellowish brown region on frons substraight 13
13. Head with almost entire face yellowish brown or whitish, occasionally U-shape mark (Fig. 1L); notauli reaching 0.65–0.70 × length of scutum *A. querceus* Olmi
 – Head with anterior third to entire of face whitish (Fig. 1F); notauli reaching 0.40–0.70 × length of scutum
 *A. maetoi* Olmi

Males (male of *Aphelopus koreanus*, *A. zhaoi* are unknown and male of *A. malayanus*, *A. nepalensis*, *A. nigriceps*, *A. urbaini* has not been found in South Korea)

1. Head with clypeus black 2
 – Head with clypeus yellowish brown or whitish 4
2. Notauli absent *A. prolatus* Mita & Olmi
 – Notauli present 3
3. Notauli reaching 0.50–0.60 × length of scutum; aedeagus tridentate (Fig. 2A) *A. atratus* (Dalman)
 – Notauli reaching 0.75–0.80 × length of scutum; aedeagus not tridentate (Fig. 2I) *A. serratus* Richards
4. Occipital carina with a notch behind ocellar region (Fig. 1B) *A. bennettii* Olmi
 – Occipital carina without a notch behind ocellar region 5
5. Basivolsella with one bristle 6
 – Basivolsella with two or more bristles 7
6. Aedeagus with distal apex trumpet-shaped (Fig. 2C); notauli reaching 0.65 × length of scutum
 *A. camus* Richards
 – Aedeagus with distal apex not trumpet-shaped (Fig. 2F); notauli reaching 0.50 × length of scutum
 *A. melaleucus* (Dalman)
7. Basivolsella with an outer basal process 8
 – Basivolsella without an outer basal process 9
8. Frontal line complete; notauli reaching 0.40–0.70 × length of scutum *A. querceus* Olmi
 – Frontal line incomplete, present in anterior half of face; notauli reaching 0.60–0.80 × length of scutum
 *A. spadiceus* Xu & He
9. Head yellowish brown except ocellar region and part of occiput black or brown (Fig. 1E); frontal line incomplete; notauli reaching 0.50 × length of scutum
 *A. luteiceps* Xu & He
 – Head black or brown except mandible, clypeus, gena, part of face whitish; frontal line complete; notauli reaching 0.50–0.70 × length of scutum *A. maetoi* Olmi

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